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Determination of shelf life and microbiological quality of *kheer* blended with ash gourd shreds

RS Bhendegave, NS Kamble, BB Chaudhari and JB Shedge

Abstract
Present investigation was to determine the shelf life as well as microbiological quality of *kheer* prepared from ash gourd shreds. The research was conducted in laboratory of Department of Animal Husbandry and Dairy Science, College of Agriculture, Vasantarao Marathwada Krishi Vidyapeeth, Parbhani during year 2021-2022. *Kheer* was prepared from buffalo milk with constant level of sugar @ 8 per cent, rice @ 2.5 per cent on basis of weight of milk and different proportion of ash gourd shreds @ 2.5, 5.0 and 7.5 per cent by weight of milk. The shelf life of finished product was studied at room temperature and refrigerated temperature on basis of 9-point hedonic scale. The study revealed that the shelf life of all *kheer* samples (T_1, T_2 and T_3) found acceptable up to 3 days at room temperature (27 ℃) and 5 days at refrigerated temperature (4 ℃). The treatment T_2 was obtained highest score for flavour (7.77), colour and appearance (7.95), body and texture (7.68) and overall acceptability (7.80) at 27 ℃ up to 3 days and flavour (7.98), colour and appearance (7.94), body and texture (7.93), overall acceptability (7.88) at 4 ℃ up to 5 days. The standard plate count and yeast mould count of *kheer* blended with ash gourd shreds @ 2.5, 5.0 and 7.5 per cent increased significantly from 7.87 x 10^3 to 18.27 x 10^3 cfu/gm. and 2.58 to 11.90 cfu/gm. The coliform count was not available in *kheer* blended with ash gourd shreds.

Keywords: *Kheer*, ash gourd, shelf life, room temperature, refrigerated temperature, microbiological analysis

Introduction
Milk provides body building proteins, bone forming minerals, lactose as well as milk fat. A variety of sweet desserts to suit different festive occasions are manufactured, mainly in unorganized sector across the country (Gupta *et al.*, 2014) [15]. Kheer is one of the significant traditional dairy products of Southeast Asian nations including that of India. It is milk based dessert comprising of rice grains gelatinized while cooking for about 45 min and sugar is added it while the cooking of rice is in progression (Aneja 1997) [2]. It is traditionally made at homegrown and cottage scale with an unadulterated innovation base. Therefore, it has less keeping quality about 2-3 days under refrigeration. Recently the concept of *kheer* is changed from rice based *kheer* to different items based *kheer* such as Cereal based, Pulse based, Tuber crop based, Fruit based, Vegetable based, etc, for improving the nutritional quality of the food.
It is energy riched, content high dietary fiber, vitamin c, mineral and low levels of anti-nutrients indicate its health benefits (Bello *et al.*, 2014) [1]. It is commonly known as white pumpkin, wax gourd, or ash gourd which is cultivated primarily in China, India, and other semitropical countries for its edible fruit that has notable medicinal value (Moon *et al*., 2009) [10]. The functionally important bioactive and therapeutic compounds of ash gourd can be used for treatment of epilepsy, ulcers and other nervous disorders. The antacid action of ash gourd helps in maintain body pH and counteracts acidity caused by some foods Grubben and Denton (2004) [5]. The pulp, leaves, seed and flowers have medicinal properties. The high content of total dietary fiber is associated with lowering blood cholesterol level and incidence of coronary heart disease and bowel disorder Palamthodi *et al.*, (2019) [11].
The aim of this study was to determine the shelf life at room temperature and refrigerated temperature on sensory basis and microbiological quality of *kheer* blended with ash ash gourd shreds.

Materials and Methods
Procurement of raw materials
The present research work was undertaken in the Department of Animal Husbandry and Dairy Science, College of Agriculture, VNMKV, Parbhani.

The fresh buffalo milk was procured from Buffalo unit, Dept. of AHDS, College of Agriculture, Parbhani. Ingredients like sugar, rice and ash gourd fruit was purchased from the local market.

Preparation of Ash gourd shreds

Ash was taken as per treatments and washed it properly. Then cut it into large parts or pieces and remove peel and make shreds using shredder. Tie shreds in muslin cloth and put it for blanching for about 6 minutes in boiling water. Remove it from water, then spreads on plate and cool at room temperature.

Preparation of *kheer* blended with ash gourd shreds

Kheer blended with ash gourd shreds was prepared in different treatment combinations as detailed in Table 1. Treatment T_0 without ash gourd shreds served as control.

Table 1: Treatment Combinations

T_0	Rice @ 2.5 per cent
T_1	Ash gourd shreds @ 2.5 per cent by weight of milk
T_2	Ash gourd shreds @ 5.0 per cent by weight of milk
T_3	Ash gourd shreds @ 7.5 per cent by weight of milk

Procedure for manufacture of *kheer* blended with ash gourd shreds

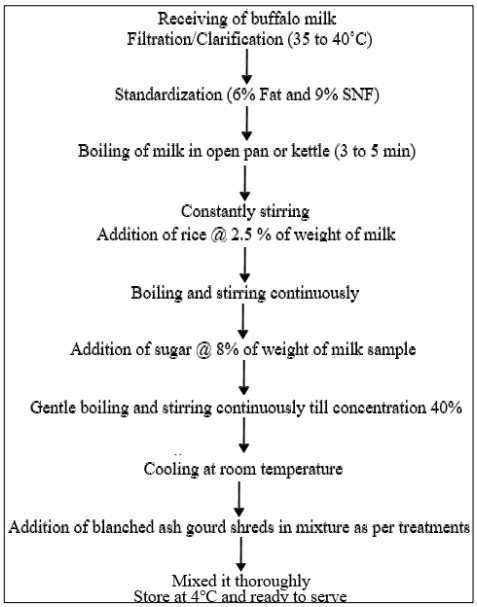

Fig 1: Flowchart for manufacture of *kheer* by using ash gourd shreds

Determination of shelf life

The study of shelf life of *kheer* blended with ash gourd shreds was carried out at room temperature (27 °C) and refrigerated temperature (4 °C) by panel of judges using 9-point hedonic scale.

Microbiological analysis

The finished product was examined for Standard plate count, Yeast mould count and Coliform count as per method described by IS Part-III (1962) [7], Marshall (1993) [9] and Hought *et al.*, (1992) [6].

Result and Discussion

Determination of Shelf Life of *Kheer* blended with ash gourd shreds

Flavour

Table 2 showed that the storage life of *kheer* prepared from ash gourd shreds was found 3 days at room temperature and 5 days at refrigerated temperature. It was noticed that the score of flavour in sample T_2 (8.45 to 7.77) was maximum up to 3 days as compared to other samples at room temperature. At refrigerated temperature the mean score of flavour for *kheer* blended with ash gourd shreds was decreased minimum up to 5 days storage period for sample T_2 (9.00 to 7.98) from 1 to 5 days.

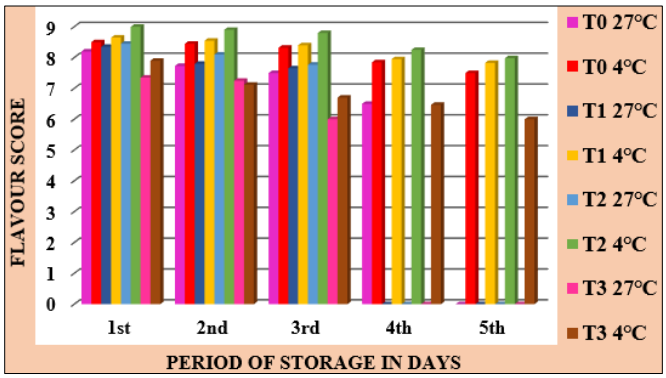

Fig 2: Flavour score of *kheer* blended with ash gourd shreds at room as well as refrigerator temperature

The results obtained in present investigation was similar with results reported by Shaikh *et al.*, (2015) [13] reported the keeping qualities of pumpkin based *kheer* for 3 (1st, 2nd and 3rd) days storage period. It was observed that the decreased in rate of flavour score as the storage period increased. Chauhan and Upadhyay (2020) [3] reported the flavour score of ready to eat *kheer* at an interval of 15 days and up to 135th days (at room temperature) and thereafter at 150th days (at refrigerated temperature). It was noticed that the flavour score decreased rapidly at room temperature as compared to refrigerated temperature during storage.

Colour and Appearance

Table 3 reported that the score of colour and appearance in sample T_2 (8.40 to 7.95) was maximum up to 3 days as compared to other samples at room temperature. At refrigerated temperature, the mean score of colour and appearance for *kheer* blended with ash gourd shreds was decreased minimum up to 5 days storage period for sample T_2 (9.00 to 7.94) from 1 to 5 days. This might be due to increased proportion of ash gourd shreds after certain limit which increase consistency of product.

The result reported in the present investigation were similar with the results obtained by Shaikh *et al.*, (2015) [13] reported the keeping qualities of pumpkin based *kheer* for 3 (1st, 2nd and 3rd) days storage period. It was observed that the decreased in rate of colour and appearance score as the storage period increased. Chauhan and Upadhyay (2020) [3] reported that the loss in colour and appearance score of ready to eat *kheer* at an interval of 15 days and up to 135th days and thereafter on 150th day. It was concluded that the changes in colour and appearance score decreased rapidly at room temperature than at refrigerator temperature.

Body and texture

Table 4 reported that the average score of body and texture of

ash gourd *kheer* during storage period of 3 days was decreased for all treatment combinations from 1 to 3 days. It was observed that the score of body and texture in sample T_2 (8.35 to 7.68) was maximum up to 3 days as compared to other samples at room temperature. At refrigerated temperature, the mean score of body and texture

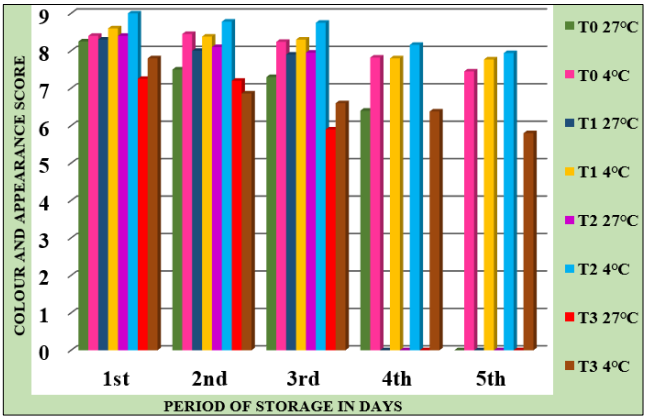

Fig 3: Colour and appearance score of *kheer* blended with ash gourd shreds at room temperature and refrigerated temperature

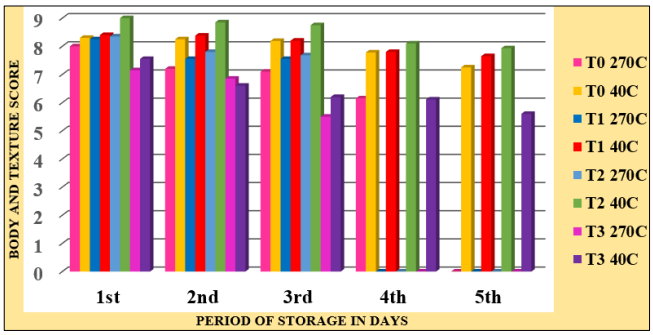

Fig 4: Body and texture score of *kheer* blended with ash gourd shreds at room and refrigerated temperature

kheer blended with ash gourd shreds was decreased minimum up to 5 days storage period for sample T_2 (9.00 to 7.93) from 1 to 5 days.

The results shown in the present investigation are similar with the results obtained by Jha *et al.*, (2011) [8] reported score of body and texture of long life *kheer* processed at high temperature was found decreased slightly from 0 day to 150 days ranged from 8.00 to 6.72. Shaikh *et al.*, (2015) [13] studied the keeping qualities of pumpkin based *kheer* for 3 (1st, 2nd and 3rd) days storage period. It was observed that the decreased in rate of body and texture score as the storage period increased. Chauhan and Upadhyay (2020) [3] observed that the score of body and texture decreased rapidly at room temperature as compared to refrigerated temperature during storage for ready to eat *kheer*.

Overall acceptability

Table 5 reported that the shelf life of *kheer* blended with ash gourd was 3 days at room temperature and 5 days at refrigerated temperature. It was revealed that the score of overall acceptability in sample T_2 (8.40 to 7.80) was maximum up to 3 days as compared to other samples. It was concluded that the average score of overall acceptability was decreased as storage period increased from 1 to 3 days at room temperatures and 1 to 5 days at refrigerated temperature. This might be due to increased proportion of ash gourd shreds after certain limit.

The result obtained in the present investigation is similar with the results reported by Jha *et al.*, (2011) [8] studied the development of a process for manufacture of long-life dairy dessert *kheer* and its physicochemical properties. The long life *kheer* processed at high temperature which was found slightly decreased overall acceptability score from 0 day to 150 days ranged from 7.54 to 5.77. Shaikh *et al.*, (2015) [13] reported the keeping qualities of pumpkin based *kheer* for 3 (1st, 2nd and 3rd) days storage period. It was observed that the decreased in rate of overall acceptability score as the storage period increased. Chauhan and Upadhyay (2020) [3] reported that during storage of *kheer* at room temperature, the score of overall acceptability was decreased from 8.10 at 0 day to 6.00 at the 135th day of storage and at refrigerator temperature, the sample was found with overall acceptability score as 8.10 at 0 day to 7.57 at 150th day. There was rapidly decreased in overall acceptability score at room temperature as compared to refrigerator temperature

Table 2: Flavour score of *kheer* blended with ash gourd shreds at room as well as refrigerator temperature.

Treatments	Temperature (°C)	Days				
		1st	2nd	3rd	4th	5th
T_0	27 °C	8.20	7.73	7.50	6.50	-
	4 °C	8.50	8.45	8.32	7.85	7.50
T_1	27 °C	8.35	7.80	7.65	-	-
	4 °C	8.65	8.55	8.40	7.95	7.83
T_2	27 °C	8.45	8.10	7.77	-	-
	4 °C	9.00	8.90	8.80	8.25	7.98
T_3	27 °C	7.35	7.25	6.00	-	-
	4 °C	7.90	7.12	6.70	6.47	6.00
Treatments	**Temperature (°C)**	**Days**				
		1st	2nd	3rd	4th	5th
T_0	27 °C	8.25	7.50	7.30	6.40	-
	4 °C	8.40	8.45	8.24	7.82	7.45
T_1	27 °C	8.30	8.00	7.90	-	-
	4 °C	8.60	8.38	8.30	7.80	7.77
T_2	27 °C	8.40	8.1	7.95	-	-
	4 °C	9.00	8.78	8.75	8.16	7.94
T_3	27 °C	7.25	7.2	5.9	-	-
	4 °C	7.80	6.86	6.6	6.38	5.8

Table 4: Body and texture score of *kheer* blended with ash gourd shreds at room and refrigerated temperature.

Treatments	Temperature (°C)	Days				
		1st	2nd	3rd	4th	5th
T_0	27 °C	8.00	7.20	7.10	6.15	-
	4 °C	8.30	8.25	8.19	7.78	7.25
T_1	27 °C	8.25	7.55	7.55	-	-
	4 °C	8.40	8.38	8.20	7.80	7.65
T_2	27 °C	8.35	7.80	7.68	-	-
	4 °C	9.00	8.85	8.75	8.1	7.93
T_3	27 °C	7.15	6.85	5.50	-	-
	4 °C	7.55	6.60	6.20	6.11	5.6

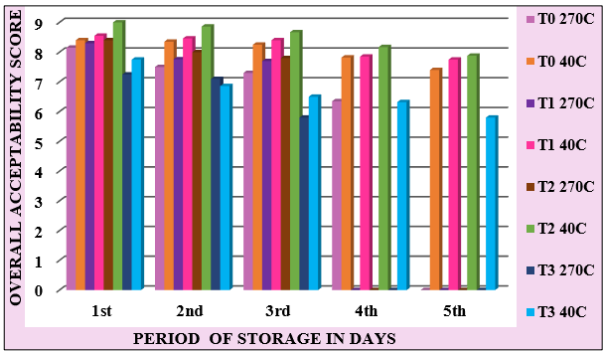

Fig 5: Overall acceptability score of *kheer* blended with ash gourd shreds at room and refrigerated temperature

Standard plate count

Table 6 showed that the mean value of standard plate count of *kheer* blended with ash gourd shreds were ranged in between 7.87 to 18.27 cfu × 10^3 per gram for treatment samples T_0, T_1, T_2 and T_3 respectively.

Table 6: Standard plate count in *kheer* blended with ash gourd shreds

Treatment	Replication				Mean Score
	Microbial count cfu X 10^3 / gm				
	I	II	III	IV	
T_0	7.03	7.00	8.00	9.45	7.87[c]
T_1	13.80	8.40	9.50	14.05	11.44[b]
T_2	17.10	14.00	15.10	17.05	15.81[a]
T_3	18.03	17.03	18.00	20.00	18.27[a]
S.E. ± 0.9243 C.D. at 5% 2.8479					

The results obtained in the present investigation is similar with the results reported by Sarode *et al.*, (2007) [12] prepared the karad *kheer* from 60 parts of standardized buffalo milk and 40 parts of saffalower milk containing 9 per cent sugar and reported that SPC count range from 1.5 × 10^3 to 5.0 × 10^3 cfu / gram. Sirsat (2012) [14] prepared ash gourd peda. It was observed that the standard plate count increased from 12 × 10^3 to 19 × 10^3 cfu/g as the level of ash gourd pulp increased from 5, 10 and 15 per cent. Dadge (2013) [14] reported the studies on preparation of sweet potato *kheer*. The standard plate count for treatment T_0, T_1, T_2 and T_3 was observed as 6.0 to 18.50 × 10^3 cfu per gram

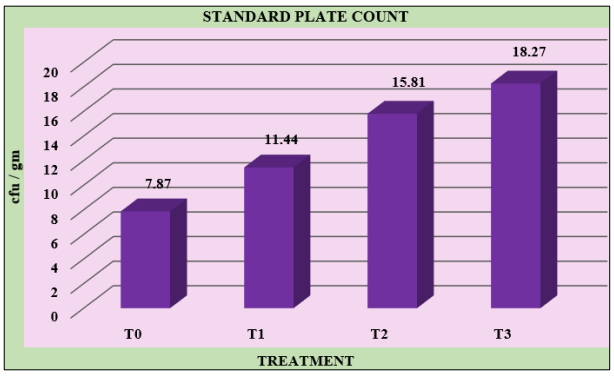

Fig 6: Standard plate count of *kheer* blended with ash gourd shreds

Yeast and mould count

Table 7 revealed that the average count of yeast and mould of *kheer* blended with ash gourd shreds for treatments T_0, T_1, T_2 and T_3 as 2.58, 5.63, 9.43 and 11.90 cfu/gm respectively. It was noticed that the yeast and mould count of *kheer* increased as the level of ash gourd shreds increased in the blend.

Table 7: Yeast and mould count in *kheer* blended with ash gourd shreds

Treatment	Replication				Mean Score
	Microbial count cfu / gm				
	I	II	III	IV	
T_0	2.00	1.00	3.05	4.25	2.58[d]
T_1	5.10	6.03	5.00	6.40	5.63[c]
T_2	9.00	11.00	7.50	10.20	9.43[b]
T_3	11.05	12.00	11.50	13.03	11.90[a]
S.E. ± 0.5847 C.D. at 5% 1.8016					

The result obtained in the present investigation is similar with the result shown by Sarode *et al.*, (2007) [12] prepared the karad *kheer* from 60 parts of standardized buffalo milk and 40 parts of safflower milk containing 9 per cent sugar and reported that yeast and mould count range from 1.3 × 10^3 to 7.5 × 10^3 cfu/ gram. Sirsat (2012) [14] prepared ash gourd peda. It was observed that the yeast and mould count increased from 4 × 10^3 to 11 × 10^3 cfu/gm as the level of ash gourd pulp increased from 5, 10 and 15 per cent. Dadge (2013) [14] reported the studies on preparation of sweet potato *kheer*. The standard plate count for treatment T_0, T_1, T_2 and T_3 was observed as 2.25 to 12.25 × 10^3 cfu per gram.

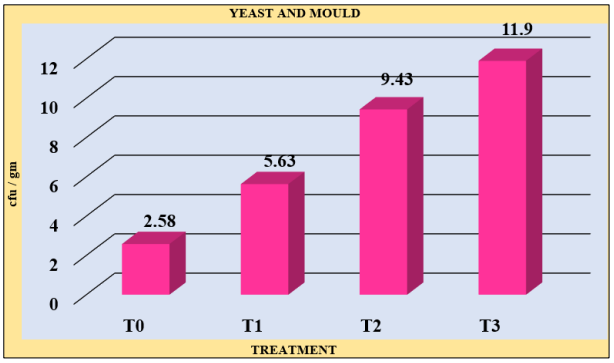

Fig 7: Yeast and mould count of *kheer* blended with ash gourd shreds

Coliform count

From below table 8, it was observed that the *E. coli* count not available in all treatment combinations and four replications of *kheer* blended with ash gourd shreds.

Table 8: Coliform count in *kheer* blended with ash gourd shreds

Treatment	Replication				Mean Score
	Microbial count cfu / gm				
	I	II	III	IV	
T_0	NA	NA	NA	NA	NA
T_1	NA	NA	NA	NA	NA
T_2	NA	NA	NA	NA	NA
T_3	NA	NA	NA	NA	NA
S.E. ± 0000 C.D. at 5% 0000					

The above mentioned result similar with the Dadge (2013) [14] studied the preparation of sweet potato *kheer*. The study revealed that the colifiorm count are found to be absent in sweet potato *kheer*.

Conclusion

From the above results it was concluded that the storage life of *kheer* prepared from ash gourd shreds was found 3 days at room temperature and 5 days at refrigerated temperature. The overall acceptability of *kheer* blended with ash gourd shreds was decreased as the storage period increased at room temperature as well as refrigerated temperature. The SPC count and Yeast and mould count of kheer blended with ash gourd shreds also increased as level of ash gourd shreds increased. The Coliform count was not available in the finished product.

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